

REMARKS

1. All previous rejections have been withdrawn.

2. The claims are newly rejected under 35 USC 112, first paragraph, on grounds that independent claim 14 contains subject matter in steps viii), ix) and x) not described in the specification in a way as to reasonably convey that the inventor had possession of the claimed invention. Regarding part of the rejected matter, Applicant amends claim 14 to state the matter in a manner more clearly supported by the specification. Regarding other parts of the rejected matter, Applicant respectfully traverses the rejection.

3. The claims are newly rejected under 35 USC 112, second paragraph, on grounds that in independent claim 14, step vii), it is unclear what limitation is intended, and that in claim 14, steps viii) and x), it is unclear what steps are performed by the computer system and in what way the steps are responsive to non-selected replets, selected replets and redundant replets. Regarding part of the rejected matter, Applicant amends claim 14 to state the matter more clearly. Regarding other parts of the rejected matter, Applicant respectfully traverses the rejection.

4. Claims 4, 5 and 14-22 are newly rejected under 35 USC 103(a) as being unpatentable over Taylor et al., Computer and Chemistry, 1999, Vol. 23, p. 365-385 ("Taylor"), in view of Chen et al., Bioinformatics, 2002, Vol. 18, No. 12, p. 1696-1698 ("Chen"), and further in view of Schwartz et al., Genome Research, 2000, Vol. 10, p. 577-586 ("Schwartz"). Claims 3-6 and 10 stand rejected under 35 USC 103(a) as being unpatentable over Taylor, in view of Chen, in view of Schwartz, and further in view of Huysmans et al., Proteins: Structure, Function, and Genetics, 1991, Vol. 11, p. 59-76 ("Huysmans"). Applicant respectfully traverses the rejection.

5. Detailed response to rejection under 35 USC 112, first paragraph

It is known to represent sequences using an ordered set of match-set entries and a backbone, where each match-set entry represents a subsequence that starts at a location "k" of the sequence. Present application, page 9, lines 27-31. The sequence may be a human gene sequence or other sequence. Present application, page 4, lines 9-16. A known pattern discovery algorithm "TEIRESIAS" generates conventional match-set entries (as shown in Table 2) for replets that match subsequences in a sequence. Present application, page 13, lines 27-33. The present application discloses a new match-set data structure and associated processes that enable an easily changeable view of a sequence representation, i.e., that enable a user to interact with a computer system so that the system generates and presents to the user a new sequence representation based on one or more new or previously unchosen replets.

Claim 14, as amended in the May 11, 2009, reply to Office action, recites that in the claimed method *"one of the subsequences is matched by a certain plurality of the replets."* This is supported in the present patent application. See at least page 4, lines 9-29; page 8, lines 27-32 ("*. . . a subsequence may be matched by more than one replet*") and page 10, lines 1-3. Non-chosen replets correspond to a subsequence but are not used (at least not initially) to represent and reconstruct the overall sequence, because another replet is initially chosen.

Claim 14, as amended in the May 11, 2009, reply to Office action, recites that the claimed method includes *"viii) the computer system generating or receiving a selection of one of the certain plurality of replets, wherein any non-selected one of the certain plurality of replets is deemed a redundant replet and the representing in step vii) is responsive to the selected one of the certain plurality of replets but not responsive to any redundant replet."*¹ This is supported in the present application at least by present application, page 10, lines 1-3, which states that "Whenever a subsequence could be represented by one or more replets or one or more combination of replets, a choice is

¹ Due to an issue about "representing" that was raised in the present Office action, "vii) the computer system representing" is amended herein above to recite "vii) the computer system generating a first representation of." Likewise, "the representing in step vii)" is herein amended to recite "generating the first representation in step vii)."

made among them and only one among these is used to represent the subsequence.” See also present application, page 8, lines 8-10. (base replet-sequence matrix is the “replet-sequence matrix constructed using only those reptlets 110 that are used to represent a sub-sequence in a sequence 105.”). ²

The term “redundant” replet was used in the claim as submitted in Applicant’s last reply, since only one chosen replet is used from among a plurality of possible reptlets that could have been chosen, all of which may be matches for the same subsequence. That is, the one or more initially non-selected, non-used reptlets are, in a sense, redundant since they were initially not used in generating a representation of the sequence. Accordingly, the claim referred to a replet that is not selected and not used as being “deemed a redundant replet.” Upon consideration of the present Office action, Applicant recognizes that the term “redundant” may be easily misconstrued.

In particular, the Office action analogizes redundant reptlets to prior art teaching of repeated subsequences within a sequence. See, for example, present Office action, page 9, lines 10-11 (pointing out that Chen shows encoding repeat regions). However, a replet *itself* is a subsequence that repeats in the sequence, or at least the investigator hopes and suspects that it does. Indeed, a reason that an investigator selects a replet is to remove repeats of the replet from the overall sequence in order to generate a simplified representation of the sequence, so that the simpler representation can be more easily compared to another sequence. See, for example, present application, page 2, line 32 through page 3, line 8; page 4, lines 9-13; page 7, lines 7-13; and page 9, lines 21-25.

Thus, while it would be redundant to call a replet a “redundant replet” in order to convey that the replet repeats (since it is at least expected that reptlets inherently repeat), Applicant recognizes that it may have introduced confusion to label an initially non-selected replet as a “redundant replet.” Accordingly, the claims are amended

² Another issue is also described in the present application that also gives rise to reptlets not initially used to represent a sequence. That is, reptlets may be added for consideration (i.e., added to the “ontology”) after match-set entries have been generated to represent a sequence. The data structure taught in the present application also allows adding reptlets after generating match-set entries for a sequence representation. Present application, paragraph 12.

herein to refer to a "non-selected replet" or an "initially non-selected replet" instead of a "redundant replet."

Concerning support for the representing being "*not responsive to any redundant replet*" (which is herein amended to recite "*not responsive to any non-selected replet*"), present application, page 10, lines 1-3, states that only the chosen replet, i.e., not any of the redundant reptels, is used to represent the subsequence.

The present Office action asserts on page 3 that the new limitation is directed to *generating* redundant reptels. However, the subject claim limitation stated that "any non-selected one of the certain plurality of reptels is deemed a redundant replet." This does not concern *generating* a redundant replet. See discussion of "redundant replet" herein above.

The present application provides an example of how the new data-structure and process for match-set entries operates, and provides support for claim 14, as amended in the previous reply to Office action, which recited that the claimed method includes "*ix) the computer system generating or receiving a selection of one of the reptels deemed a redundant replet in step viii); and x) the computer system representing and presenting the sequence, wherein the representing in step x) is responsive to the one of the reptels indicated by the selection in step ix) instead of the one of the reptels indicated by the selection in step viii).*"^{3 4} That is, the present application describes "new reptels" (i.e., reptels initially deemed redundant in the sense they were initially not chosen) that are subsequently used for representing the sequence after a Replet-sequence matrix was constructed using one or more initially chosen reptels. Present application, page 12, line 30 through page 13, line 6 ("This example demonstrates how new reptels are accommodated, and describes an algorithm and methodology for reconstructing the

³ Further due to the issue about "representing" that was raised in the present Office action, the claim is amended herein to recite "*x) the computer system generating and presenting a second representation of the sequence, wherein the representation in step x) . . .*"

⁴ Due to confusion about "redundant," the claim is amended herein to recite "*ix) the computer system generating or receiving a selection of a replet that was not selected in step viii); and x) the computer system representing and presenting the sequence, wherein the representing in step x) is responsive to the one of the reptels indicated by the selection in step ix) instead of the one of the reptels indicated by the selection in step viii).*"

sequences from the data structures. Let the set of optimal patterns chosen to represent the set of sequences be Φ_{α} . . . Let the entire set of patterns chosen for representing the sequences be $\Phi+$. . . Let the new replet to be added after the Replet-sequence matrix for $\Phi+$ is constructed be {actata}. . . ")

In the previous reply to Office action, claim 14 was amended to recite "*the computer system performs the representing in step x) by reference to the first and second parameters for the one of the reptlets indicated by the selection in step ix), such that the computer system performs the representing in step x) without repeating the generating of position parameters performed in step iii).*" Herein claim 14 is amended to further recite "*viii) . . . and wherein the selected one of the reptlets has a position within the sequence, and wherein after receiving the selection the computer system updates the first and second parameters for any redundant replet associated with the selected one of the reptlets, the updating being responsive to the position of the selected one of the reptlets.*" And Claim 14, step x), is also amended herein to recite "*using the position parameters updated in step viii)*" instead of "*without repeating the generating of position parameters performed in step iii).*" Support for these limitations are provided in the present application in at least the following.

The present patent application discloses that the reptlets not chosen "also have an entry in their match-set entries against the sequences, which enables processing based on these reptlets. " Present application, paragraph page 10, line 5-13. But these entries would be invalid since their matching subsequence is represented by the replet that has been chosen and then the subsequence has been removed from the sequence, so that conventional Match-set entries for these non-chosen reptlets would not enable rebuilding of the sequence. Present application, paragraph page 10, lines 5-13. That is, if a given replet was initially not chosen to represent a sequence and then the choice of reptlets was later changed, where the given replet was then chosen, the conventional match-set entry for the given replet would not be valid for rebuilding of the sequence, since the sequence was represented based on the replet that was earlier chosen, and the subsequence for the earlier chosen replet was accordingly removed from the sequence.

As a way to address this problem, according to an aspect of an embodiment of the present invention, particular match-set entries for each replet include, as disclosed in the present application, the conventional "k" position parameter and a modification, i.e., a " δ " position parameter that indicates the number of positions before or after the position k that the replet starts matching the subsequence. Present application, page 7, lines 25-32 and page 10, lines 5-13. Further, the k and δ parameters are updated for each non-chosen replet after a replet is chosen to represent the sequence. Present application, page 10, lines 5-13. ("The parameters 'k' and ' δ ' are adjusted. The parameter 'k' of the Match-Set entry corresponding to replet ϕ [i.e., a non-chosen replet] is set to the 'k' of the replet ϕ_1 that is chosen to represent the subsequence that replet ϕ matches partially or completely. Parameter ' δ ' is set to the number of positions before ($-\delta$), or after ($+\delta$) 'k' of ϕ_1 that replet ϕ starts matching the subsequence. ").

Concerning this matter of updating, see also page 13, lines 5-6 ("Let the new replet to be added after the Replet-sequence matrix for $\Phi+$ is constructed be {actata}. .") and page 14, lines 10-16 ("Table 3 below presents the information obtained by transforming the results in Table 2 above, generated using the TEIRESIAS algorithm, such that the information is structured in accordance with the required Match-Set data structure. As an example, consider the first entry in Table 2. This entry provides the information concerning the pattern 'cgcgcgcgcg', that is the sequence in which occurs (0) and the offset (19) of the occurrence. The entries of Table 2 are modified to have k, δ parameters, and the resulting set of Match-Set entries as shown in Table 3 below.").

This change in the match-set, as disclosed in the present application, enables mapping that would otherwise be more difficult or to perform and would otherwise require more resources. Present application, page 10, lines 15-25.

Also in this regard, the present application discloses variation information that has to be stored if patterns $\Phi\alpha$ are used to represent the sequence, \mathfrak{R} , and mapping between the variation, position, sequence and replet for the $\Phi\alpha$ reptes. See variation table 4 and indirection table 5. Formation of the arrays is illustrated schematically and discussed in the context of an example in the present application. Figure 4 in the present application illustrates, and page 16, lines 9-13, describe a base replet-sequence

matrix for the Φ_a example. FIG. 5 presents a replete-sequence-matrix 500 "that is modified to accommodate the overlapping pattern {aa..a . . . a} and the schematic representation of the resulting replet-sequence-matrix," where "[t]he base-replet-connector allows the resolving of the base pattern that was chosen against the non-base pattern (In this case, the pattern is {aaataa..aaa})." Present application, page 16, lines 17-20, as previously amended to conform the text and the figure. FIG. 6 presents a replete-sequence-matrix 600 "that is modified to include a new replet {actata}, and for which base-replet connectors are added from actata's replet instances to the corresponding tactata.....ttac's replet instances. Present application, page 16, lines 24-27, as previously amended to conform the text and the figure.

The foregoing summarizes a new match-set entry data structure for replet position that enables an easily changeable view of a sequence representation, i.e., a new sequence representation based on previously unchosen reptlets, which may be new reptlets. The new representation uses position parameters of the match-set entries for one or more initially non-chosen ("redundant") reptlets, where the position parameters of the one or more redundant reptlets were updated after an initial replet was chosen for the sequence representation.

The match-set entry data structure includes an Is-base-replet array, a Pointer to Base-replet array, a sequence-formation-edges array, a pointer to next-pattern instance, and a pointer to previous-pattern instance, as summarized in Table 7. The sequence-formation-edges array is a vector, such that the entry at index "i" represents the ith instance of the pattern on the sequence sequence-id, the matching-offsets array contains the various offsets at which the replet has matched the sequence, and the is-base-replet array indicates whether the replet was used to represent the sequence at that offset provided in matching-offsets array. Present application, page 18, lines 18-25.

Further, "FIGS. 9A to 9C present "snapshots" of the variables used in the pseudo-code algorithm presented in FIG. 7 at the various stages in the algorithm when the sequence (seq3) is reconstructed from the data-structure. FIG. 9A is obtained as result of the execution of Step 820 of the algorithm, as described above. FIGS. 9B and 9C depict the values that each variable in Step 830 takes and the iteration at which

those values were obtained. FIG. 9C represents Step 840 of the algorithm, in which the complete rebuilt sequence (seq3) is output as result." Present application, page 18, lines 27-33.

6. Detailed response to rejection under 35 USC 112, second paragraph

The Office action states it is unclear what limitation is intended in claim 14 with regard to "vii) the computer system representing the sequence . . . and at least a portion of the stored match-set data." The Office action states that this limitation merely refers to the previously recited computer system.

To address this rejection, "vii) the computer system representing . . ." is amended herein above to recite "vii) the computer system generating a first representation of . . ."

The Office action states it is unclear what actual steps are performed by the computer system and in what way these steps are responsive to non-selected replets, selected replets, and redundant replets, with regard to "wherein one of the subsequences is matched by a certain plurality of the replets and the method further includes: viii) the computer system generating or receiving a selection of one of the certain plurality of replets, wherein any non-selected one of the certain plurality of replets is deemed a redundant replet and the representing in step vii) is responsive to the selected one of the certain plurality of replets but not responsive to any redundant replet."

To address this rejection, "the representing in step vii). . ." is herein amended to recite "generating the first representation in step vii) . . ."

The Office action states it is unclear what actual steps are performed by the computer system and in what way the claimed "representing" is responsive to replets, with regard to "the computer system representing and presenting the sequence, wherein the representing in step x) is responsive to the one of the replets indicated by the selection in step ix) instead of the one of the replets indicated by the selection in step viii) and wherein the computer system performs the representing in step x) by reference to the first and second parameters for the one of the replets indicated by the

selection in step ix), such that the computer system performs the representing in step x) without repeating the generating of position parameters performed in step iii)."

To address the rejection concerning what steps are performed by the computer system, "(x) the computer system representing and presenting the sequence, wherein the representing in step x). . ." is amended herein above to recite "(x) the computer system generating and presenting a second representation of the sequence, wherein the representation in step x). . ." Likewise, "wherein the computer system performs the representing in step x) by reference to the first and second parameters for the one of the replets indicated by the selection in step ix), such that the computer system performs the representing in step x) without repeating the generating of position parameters performed in step iii)" is amended herein above to recite "*wherein the computer system performs the generating in step x) by reference to the first and second parameters for the one of the replets indicated by the selection in step ix), such that the computer system performs the generating in step x) using the position parameters updated in step viii).*"

With regard to the rejection concerning *what way* the claimed "representing" is responsive to replets, Applicant respectfully traverses, particularly in view of the amendments herein that more particularly and clearly point out that the computer system generates and presents first and second representations of the sequence. That is, Applicant submits it is clear and definite to state that a computer system generates a representation of a sequence in response to a replet.

7. Detailed response to rejection under 35 USC 103(a)

A. The present Office action presents a discussion of the references relied upon for the rejection, which is helpful as far as it goes. However, in some instances the Office action does not particularly point out which particular claim limitations are addressed by which teachings in which references, or even by which references. This presents an obstacle for presenting a response that adequately addresses the rejection. If the amendments and remarks herein do not result in allowance, Applicant respectfully

requests that the next Office action clearly point out for each claim limitation what reference is relied upon and what portion of the respective reference is relied upon.

B. Applicant argued in the reply of 05/11/2009 that the combination of Taylor, Schwartz, and Huysmans does not teach *allowing the user to choose among redundant replets for user control of output*. The present Office action states that these features are not recited in the rejected claim and that the argument is, therefore, unpersuasive. However, claim 14 does recite these features in great detail in the following manner: a plurality of replets match a subsequence of the sequence ("one of the subsequences is matched by a certain plurality of the replets"); a selection of an initial one of these replets (step viii); generating a first representation responsive to the first selection (steps vii and viii); updating parameters of the unselected ones of these replets responsive to the selected replet (step viii); a selection of another replet, which was not initially selected (step ix); and generating a second representation responsive to the second selection, wherein the second representation uses the updated parameters (step x).

C. The Office action states that it would have been obvious "to modify the method of Taylor by generating or receiving replets, wherein non-selected replets are deemed redundant and the representing is responsive to selected replets but not responsive to redundant replets, as in claim 14 (step viii), or by generating or receiving redundant replets, as in claim 14 (step ix), since Chen shows methods for encoding of repeat regions in the DNA sequences [p. 1696-97, Methods, Fig. 1], and since Schwartz shows methods for producing redundant matches and removing redundant alignments [p.580, Col. 2, Fig. 2, Fig. 6]." The motivation would have been to improve sequence matching by accommodating small overlaps between adjacent alignments [Schwartz, p.585, Col. 1, ¶3]. Applicant respectfully disagrees, particularly in view of amendments herein to eliminate use of the term "redundant replet" and more clearly point out the meaning of the claim.

As explained herein above, a replet is a repeat region in a sequence. Reference in the claim to "redundant replet" should not be construed merely as a repeat region in a sequence.

The claim has been amended herein to make particularly clear that the present application discloses a new match-set data structure and associated processes that enable an easily changeable view of a sequence representation. That is, the computer system generates and presents to the user a new sequence representation based on one or more new or previously unchosen replets after an initial representation that was based on an initially chosen replet, and the computer system generates this new representation in a novel and nonobvious manner, wherein the new representation uses location parameters that were updated responsive to the initially chosen replet.

In this regard, amended claim 14 recites "viii) the computer system generating or receiving a selection of one of the certain plurality of replets, wherein generating the first representation in step vii) is responsive to the selected one . . . and wherein after receiving the selection the computer system updates the first and second parameters for any non-selected replet associated with the selected one of the replets, the updating being responsive to the position of the selected one of the replets . . . and x) the computer system generating and presenting a second representation of the sequence, . . . wherein the computer system performs the generating in step x) by reference to the first and second parameters for the one of the replets indicated by the selection in step ix) [i.e., a second selection, which is a selection of an initially non-chosen replet], such that the computer system performs the generating in step x) using the position parameters updated in step viii)," as claimed. The cited references do not teach or suggest this. Indeed, the cited references do not even recognize the problem addressed by the recited process, much less address or teach the recited process.

D. The Office action states that it would have been obvious "to modify the method of Taylor by representing sequences responsive to the one of the replets indicated by the selection in step ix) instead of the one of the replets indicated by the selection in step viii) and wherein the computer system performs the representing in step x) by reference to the first and second parameters for the one of the replets

indicated by the selection in step ix), such that the computer system performs the representing in step x) without repeating the generating of position parameters performed in step iii), as in claim 14 (step x), since Taylor provides a matching program that represents sequences by reference to positional and weight parameters [Fig. 4] and since Schwartz represents sequence based on positional parameters, length, and percent identity [Fig. 1]."

Applicant submits that this impermissibly substitutes a conclusory statement for teaching in the prior art and articulated reasoning. In *KSR International Co. v. Teleflex Inc.*, et al., for example, the prior art taught all aspects of the claim at issue. See *KSR*, 550 US 398, 413 (2007) ("Asano taught everything contained in claim 4 except the use of a sensor to detect the pedal's position and transmit it to the computer controlling the throttle. That additional aspect was revealed in sources such as the '068 patent and the sensors used by Chevrolet."). When determining whether a claim is obvious, an examiner must make "a searching comparison of the claimed invention - including all its limitations - with the teaching of the prior art." In *re Ochiai*, 71 F.3d 1565, 1572 (Fed. Cir. 1995). Thus, "obviousness requires a suggestion of all limitations in a claim." *CFMT, Inc. v. Yieldup Intern. Corp.*, 349 F.3d 1333, 1342 (Fed. Cir. 2003) (citing *In re Royka*, 490 F.2d 981, 985 (CCPA 1974)). Moreover, "there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR Int'l v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

Regardless of the motivation offered in the present Office action, no reasoned basis is provided for the conclusion. That is, it does not follow from i) a matching program that represents sequences by reference to positional and weight parameters, as the Office action asserts is taught by Taylor, and ii) representing sequence based on positional parameters, length, and percent identity, as the Office action asserts is taught by Schwartz, that it would have been obvious "to modify the method of Taylor by representing sequences responsive to the one of the replets indicated by the selection in step ix) instead of the one of the replets indicated by the selection in step viii) and wherein the computer system performs the representing in step x) by reference to the

first and second parameters for the one of the replets indicated by the selection in step ix), such that the computer system performs the representing in step x) without repeating the generating of position parameters performed in step iii), as in claim 14 (step x)."

Further, claim 14 has been amended herein as described above to all the more clearly point out how the invention is patentably distinct from merely representing sequences by reference to positional, weight, length and percent identity parameters.

REQUESTED ACTION

For the reasons explained herein above, Applicant submits that the claim 14, as amended herein, is patentably distinct. Applicant submits, further, that claims 3-6 and 15-22 are patentably distinct at least because they depend upon claim 14. Applicant, therefore, requests that all the claims be promptly allowed and the application passed to issuance.

The present Office action presents a discussion of the references relied upon for the rejection, which is helpful as far as it goes. However, in some instances the Office action does not particularly point out which particular claim limitations are addressed by which teachings in which references. This presents an obstacle for presenting a response that adequately addresses the rejection. If the amendments and remarks herein do not result in allowance, Applicant respectfully requests that the next Office action clearly point out for each claim limitation what reference is relied upon and what portion of the respective reference is relied upon.

Respectfully submitted,

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